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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/718,707	11/24/2003	Mark Ramsbey	50432-657	9931

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EXAMINER	
DUONG, KHANH B	
ART UNIT	PAPER NUMBER
2822	

DATE MAILED: 05/04/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/718,707	RAMSBEY ET AL.	
	Examiner	Art Unit	
	Khanh B. Duong	2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 November 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *10-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *10-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 November 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *11/24/03*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

This Office Action is in response to the Preliminary Amendment filed on November 24, 2003.

Accordingly, claims 1-9 and 22-26 were cancelled.

Currently, claims 10-21 are pending.

Priority

This application is a Divisional of application No. 09/143,089 filed August 28, 1998, now abandoned.

Specification

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: METHOD FOR FORMING NITROGEN-RICH REGIONS IN NON-VOLATILE SEMICONDUCTOR MEMORY DEVICES.

Claim Objections

Claim 18 is objected to because of the following informalities: lines 3 and 4, "1 x 1014" and "1 x 1016" should be --1 x 10^{14}-- and --1 x 10^{16}--.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 11-14 and 18-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Re claim 11, line 11, after "within", "the first layer" is unclear and confusing and should be --the first gate--.

***Other claims are rejected as depending on the rejected base claim.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 10, 11, 15, 18, 19 and 21 are rejected under 35 U.S.C. 102(b) as being anticipated by Gardner et al. (U.S. Patent No. 5,937,301).

Re claims 10, 11, 15, 19 and 21, Gardner et al. ("Gardner") discloses in FIGs. 2A-2 a method for forming a semiconductor device, the method comprising: forming a first dielectric layer 205; forming a first gate 203 on the first dielectric layer 205; forming at least a portion of a

second dielectric layer 207 (silicon dioxide) on the first gate 203; and then implanting nitrogen ions 209 through the second dielectric layer 207 and into the first gate 203, the implanted nitrogen ions 209 forming a first nitrogen concentration profile 215 within the first gate 203 [see col. 3, line 7 to col. 4, line 35].

Gardner further discloses performing anneal process (thermal energy) to distribute (migrate) the implanted nitrogen ions in areas including the gate 203 [see col. 3, line 64 to col. 4, line 9]. Note that the use of an anneal process to migrate implanted nitrogen ions in a gate is also disclosed by applicants [see FIG. 5; Specification, page 8, 4th and 5th paragraphs]. Since Gardner discloses substantially the same process conditions as the claimed invention, it is inherent that the anneal process causes the first nitrogen concentration profile 211 to be altered to form a second nitrogen concentration profile within the first gate 203, the second nitrogen concentration profile comprising a first nitrogen-rich region, a second nitrogen-rich region and a contiguous reduced-nitrogen region located between the first nitrogen-rich region and the second nitrogen-rich region, the contiguous reduced-nitrogen region having a lower concentration of nitrogen than the first nitrogen-rich region and the second nitrogen-rich region.

Re claim 18, Gardner discloses "implantation energies and concentrations are typically selected in consideration of the depth of the nitrogen peak 211" and "suitable implantation energies and concentrations for a nitrogen implant range from about 5 KeV to 80 KeV and 1E14 to 2E16 atoms/cm^2, respectively" [see col. 3, lines 37-42].

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner.

Re claims 12-14, Gardner discloses "implantation energies and concentrations are typically selected in consideration of the depth of the nitrogen peak 211" and "suitable

implantation energies and concentrations for a nitrogen implant range from about 5 KeV to 80 KeV and 1E14 to 2E16 atoms/cm^2, respectively". However, Gardner fails to disclose specific claimed parameters regarding the atomic percentages of nitrogen in the first and second nitrogen-rich regions and the contiguous reduced-nitrogen region.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to optimize and select appropriate parameters regarding the atomic percentages of nitrogen regarding the atomic percentages of nitrogen in the first and second nitrogen-rich regions and the contiguous reduced-nitrogen region. The selection of parameters such as energy, power, concentration, temperature, time, depth, thickness, etc., would have been obvious and involve routine optimization which has been held to be within the level of ordinary skill in the art. "Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may be impart patentability to a process if the particular ranges claimed produce new and unexpected result which is different in kind and not merely degree from results of prior art ... such ranges are termed 'critical ranges' and the applicant has the burden of proving such criticality ... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation". *In re Aller*, 105 USPQ 233, 235 (CCPA 1955). See also MPEP 2144.05.

Claims 16, 17 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner in view of Tanigami et al. (U.S. 6,069,041).

Re claims 16 and 17, Gardner discloses forming a silicon oxide layer 207 on the first gate 203 prior to the step of forming the first nitrogen-rich region and the second nitrogen-rich region within the first gate 203 previously as discussed above. However, Gardner fails to disclose forming a silicon nitride film and a second silicon dioxide film on the first silicon dioxide film 207.

Tanigami et al. ("Tanigami") suggests forming a silicon nitride film and a second silicon dioxide film on a first silicon dioxide film for the purpose of forming an ONO film [see col. 5, lines 59-66].

Since Gardner and Tanigami are from the same field of endeavor, the purpose disclosed by Tanigami would have been recognized in the pertinent prior art of Gardner.

Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the method disclosed by Gardner as suggested by Tanigami, since Tanigami states at column 5, lines 39-49 that ONO is a preferable interlayer capacitive film having a dielectric constant of more than a predetermined value.

Re claim 20, Gardner fails to disclose the step of applying thermal energy to the first gate causing an internal temperature within the first gate of between about 900 and about 1100°C.

Tanigami suggests the step of applying thermal energy to the first gate causes an internal temperature within the first gate of between about 700 to about 1200°C [see col. 5, line 19-24].

Since Gardner and Tanigami are from the same field of endeavor, the purpose disclosed by Tanigami would have been recognized in the pertinent prior art of Gardner.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to optimize and select an appropriate temperature range within the range as suggested by Tanigami. The selection of parameters such as energy, power, concentration, temperature, time, depth, thickness, etc., would have been obvious and involve routine optimization which has been held to be within the level of ordinary skill in the art. "Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may be impart patentability to a process if the particular ranges claimed produce new and unexpected result which is different in kind and not merely degree from results of prior art ... such ranges are termed 'critical ranges' and the applicant has the burden of proving such criticality ... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation". *In re Aller*, 105 USPQ 233, 235 (CCPA 1955). See also MPEP 2144.05.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington,* 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 10-21 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-11 of U.S. Patent No. 6,001,713 ("Patent '713") in view of Gardner.

Patent '713 discloses substantially all the limitations as claimed but fails to disclose implanting nitrogen ions through the second dielectric layer and into the first gate to form a first nitrogen concentration profile with the first gate.

Gardner suggests in FIG. 2C implanting nitrogen ions through a second dielectric layer 207 and into a first gate 203 to form a first nitrogen concentration profile 215 with the first gate 203 [see col. 3, lines 30-42].

Since Patent '713 and Gardner are from the same field of endeavor, the purpose disclosed by Gardner would have been recognized in the pertinent prior art of Patent '713.

Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the method of Patent '713 as suggested by Gardner because of the desirability to use the second dielectric layer as a shield to protect the surface of the first gate from implant damage.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The following U.S. Patents disclose relevant teachings regarding implantation of nitrogen ions into gate structures: Ramsbey '276, Trivedi '661, Kuroi '425, Kobushi '368 and Wu '585.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khanh B. Duong whose telephone number is (571) 272-1836. The examiner can normally be reached on 10:00-6:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

KBD

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